



**ISSUE #126**

**Jib and Genoa Controls**

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## Take control of your headsail

The mainsail may be the biggest sail on most boats, but the jib provides a relatively large share of the boat's driving force, for two reasons. First, the jib is not sitting behind a mast, so it sails in clear air with minimal turbulence. Second, the jib operates in a continuous lift that is created when the wind bends to pass on the leeward side of the main. Because of this, the jib is fuller and more powerful, and trimmed farther off centerline, than the mainsail.

While the mainsail is critical for the balance of the boat, the jib provides pure horsepower and drive. That's why it is important to find the optimal jib shape for any combination of wind and waves, and to 'shift gears' by adjusting that shape whenever conditions change. Unlike the mainsail, however, the jib is not attached to a rigid spar, so you can't fine-tune its shape as much. For this reason you must give the headsail priority when adjusting the backstay (which affects the shape of both sails), and you must fully utilize the few sail controls that do exist for the jib.

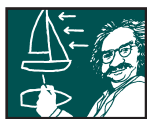
A sail control is a device that helps us change the sail's shape while racing. The primary controls affecting the jib and genoa are the jib sheet, jib lead position, jib halyard (which controls luff tension) and the backstay or mainsheet (primary ways to control headstay sag). These systems allow us to adjust the depth of the sail, the position of that depth, the sail's twist and the shape of its leading edge.

In order to get fast upwind shapes, we have to know how each sail control works. When you pull harder on the jib halyard and add tension along the luff, for example, what happens? And how does each control interact with the others to affect the shape of your jib or genoa? This issue will take an in-depth look at four major headsail controls, plus a few other subjects like telltales, changing gears and finding the upwind groove. •

**This jib has a relatively flat shape that is good for pointing and keeping the boat from getting overpowered in this breeze. The backstay has been pulled as tight as possible to minimize headstay sag and give the sail a flat entry. The top windward telltales are standing straight up because the skipper is feathering the boat to keep it flat, and the sail is twisted a lot so it won't backwind the main (which is trimmed with the traveler all the way to leeward).**



JH Peterson photo



# Visualize the shape of your jib

Before we talk about how you can use sail controls to change the shape of your headsail, let's quickly review how we look at that shape in the first place. In this issue we will talk about how the various headsail controls affect four basic measures of sail shape: overall depth (fullness), the position of maximum draft, the leading edge angle and twist. Each of these has a large effect on the sail's total power and performance.

**Depth of the sail** – The depth (also called fullness or draft) of the jib/genoa is essentially a measure of the sail's roundness. A sail that is very curved is also quite deep. In general, depth produces power so a deeper sail is more powerful than a flatter one (but also has more drag).

Almost all the headsail controls affect the depth of the sail. Pulling on the backstay, for example, reduces headstay sag and flattens the sail. Moving the jib lead aft makes the bottom of the sail flatter, while more tension on the jib halyard pulls draft out of the sail.

It's usually good to have a relatively full sail in light air or

whenever you have more waves than wind, and a flatter sail in flat water or moderate air (for pointing) or in heavy air to depower. Because the jib is in a perpetual lift created by the mainsail, jibs are usually a bit deeper than mainsails.

**Position of maximum draft** – For most jibs and genoas, the deepest part of the sail should be a bit forward of the center of the sail – roughly 40 to 45% of the way from luff to leech. You can move the draft forward by generating more luff sag, or by pulling harder on the jib halyard (or jib cunningham) to get more luff tension. You can move the draft aft by reducing luff sag or decreasing luff tension.

**Leading edge angle** – The leading edge angle is a measure of the roundness of the forward part of the jib. If the front of the jib is flat (fine),

the sail can point high but it will be 'critical' (i.e. always on the edge of stalling) and hard to keep in the groove. A genoa with a rounder luff won't point as high, but it will be more forgiving and will give the helmsperson a wider 'groove.'

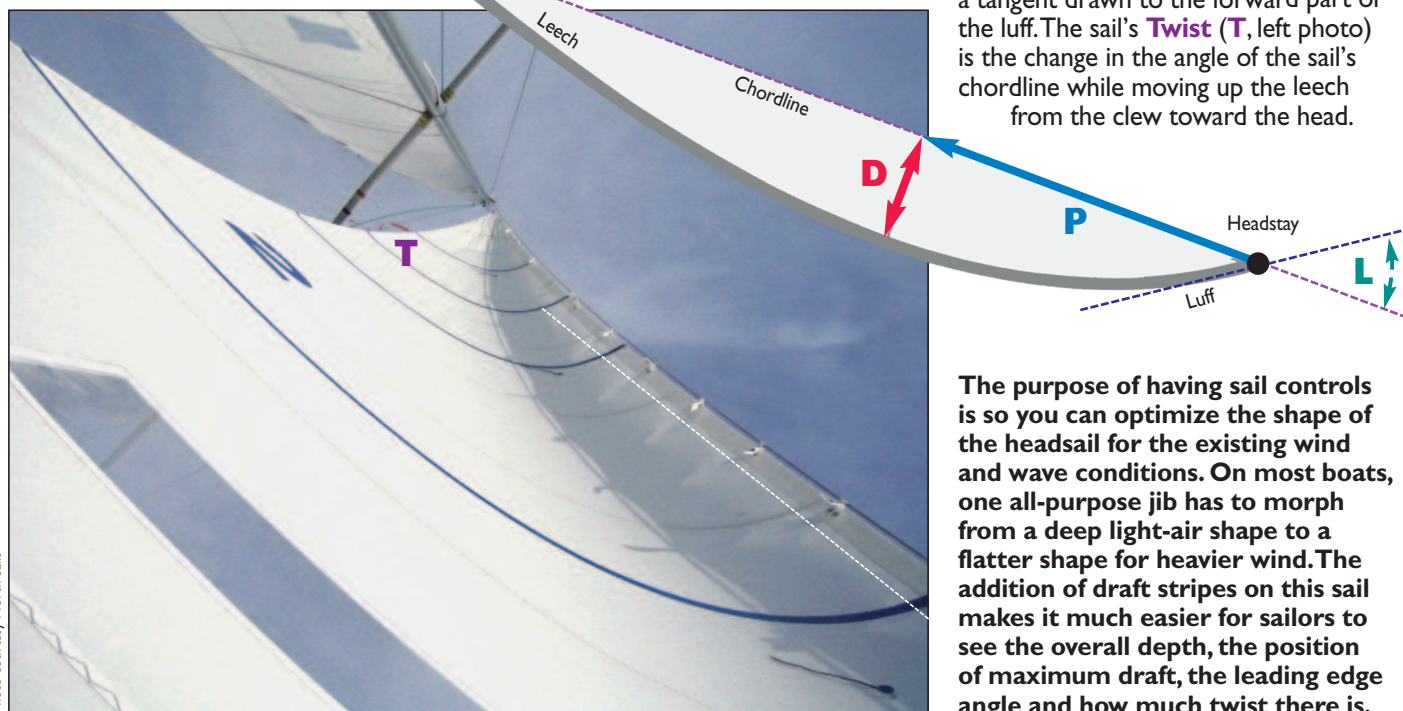
**Twist** – Twist is the change in the angle of the sail's chordline as you go from the bottom to the top of the headsail. Every jib has at least some twist (because the wind blows the leech to leeward). In general you want more twist in light air, waves and in heavy air when you need to depower the sailplan. Minimize twist in ideal pointing conditions with moderate air and flat water.

In the rest of this issue we will talk much more about optimal sail shape and how the jib trimmer can use the available controls to modify these basic sail shape measures. •

## Four elements of headsail shape

This cross-sectional view of a headsail shows four basic sail shape factors. The **Depth (D)** of this sail is a measure of how round it is (i.e. how far the sail is from a chordline drawn between luff and leech). The **Position of maximum draft (P)** is determined by how far aft the deepest part of the sail is from the luff. The

**Leading edge angle (L)** is the angle between the sail's chordline and a tangent drawn to the forward part of the luff. The sail's **Twist (T)** (left photo) is the change in the angle of the sail's chordline while moving up the leech from the clew toward the head.



The purpose of having sail controls is so you can optimize the shape of the headsail for the existing wind and wave conditions. On most boats, one all-purpose jib has to morph from a deep light-air shape to a flatter shape for heavier wind. The addition of draft stripes on this sail makes it much easier for sailors to see the overall depth, the position of maximum draft, the leading edge angle and how much twist there is.



# Headsail Controls

There are many ways to adjust the shape of your jib or genoa. Here is a visual inventory of these tools – we will look at each one in much greater detail in the rest of this issue.

## Headstay (or Luff) sag

“Sag” is the distance between the headstay (the luff of the sail) and a straight line drawn from the head of the sail to its tack. The amount of sag is a key factor in determining the overall power of the sail. More sag means a fuller, more powerful jib with its draft farther forward. A straighter headstay means a flatter, draft-aft sail which is less powerful but points higher. Headstay sag is controlled primarily by tension on the backstay and mainsheet.

## Luff tension

The jib halyard is used to adjust tension of the fabric along the luff of the sail. More halyard pulls the cloth tighter, moving draft forward and flattening the sail. Less halyard allows the draft to move aft, making the sail fuller and more powerful.

## Luff tension

On some boats, you change luff tension by moving the jib tack up and down, like you adjust the cunningham on the mainsail.

## Backstay, Mainsheet

These two controls have a big impact on headsail shape. They move the top of the mast forward and aft, which changes headstay sag and affects the depth and draft position in the sail.

## Jib Sheet

The sheet is the ‘throttle’ for your genoa or jib. It has a big effect on the sail’s twist and is the primary means for ‘shifting gears’ when conditions change. (This trimmer is ‘cross-sheeting’ to the windward side.)

## Jib lead position

On almost every boat you can move the jib lead forward and aft; on some you can also move it in and out. The position of this sheeting point will have a big effect on the sail’s depth, its twist and the slot.





# Calibrate, track, compare your settings

The wind and wave conditions are always changing, and this means sail shapes must constantly change as well. The jib shape that is ideal in five knots of wind would be very slow in 15 knots. On almost every boat, the jib trimmer has a number of ways to control and change the shape of their headsail.

In this issue we will talk about four specific tools you can use to alter the three-dimensional shape of a jib or genoa:

1. **Jib sheet** – controls how far in or out you trim the sail;
2. **Jib lead position** – can often be moved in both the fore-and-aft and lateral directions;
3. **Headstay sag** – also called luff sag; controlled by backstay and mainsheet tension; and
4. **Luff tension** – the tightness of the fabric along the jib luff, controlled primarily by the halyard.

The key to being a good trimmer is the ability to adjust each of these controls so you have the best sail shape for any wind and wave condition. What shapes are fastest? That is something you learn from experience, by carefully observing the trim settings that seem to be fast relative to other boats across a wide range of conditions.

Once you find a fast shape, it's critical to be able to reproduce that shape in the next race or regatta. To do this effectively you need a reliable system for keeping track of your sail controls.

**Calibrate.** Use reference marks and number scales to help measure and record trim settings. Put marks near your spreader tips to help you judge leech position, for example, and figure out a way to quantify backstay tension (*see next page*). These markings are key for being

able to reproduce fast settings when you have similar conditions again.

• **Organize your numbering system** so higher numbers always represent the settings you use for more wind. For example, the scale on your jib halyard should be oriented so the higher numbers are lower on the mast. This way you go to a higher number (i.e. more halyard tension) as the wind increases.

**Track.** Once you have a good system of calibration, keep track of what settings are fast in various conditions. You can try doing this by memory, but that is usually not nearly as good as keeping a written record of things you learn about your jib or genoa.

One way to do this is to create a chart like the one on page 16. In each box, add a quantifiable trim setting that, based on experience in your boat, is fast for that wind range. For example, in the box for Jib Sheet and Medium Air, you might add something like, "Leech trims to 8 cm inside spreader tip."

**Compare.** Your competitors are a great source of go-fast ideas about jib trim (or anything else), so keep an eye on them, especially early in a race or series or season (when you see them for the first time and you are open to go-fast ideas).

Look carefully at the shape of their sails (e.g. depth, draft position, twist) and their trim settings. For example, how much jib luff tension are they using? Do they have 'speed wrinkles' along the luff and, if so, how pronounced are these? Pay particular attention to boats that are going faster than you, and don't be afraid to copy their set-up.

• **Use numbering systems** that can be compared to other boats in your class. When you mark your jib lead positions, for example, use the same method as other boats. This way if you find a sailmaker or other competitor who is willing to share, you can transfer their fast settings to your own boat. •



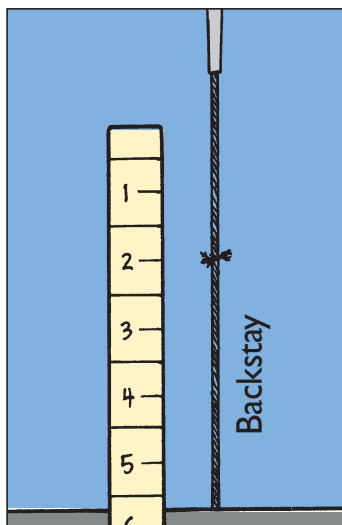
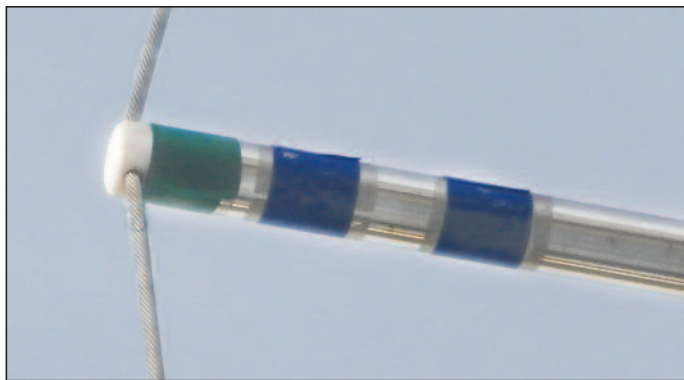
JH Peterson photo

There are a number of ways you can mark your jib or genoa to help you see its shape and optimize the use of sail controls. Draft stripes are the most common. By putting just one or two dark horizontal stripes on your jib (*see Etchells #76 above*), you can easily see the amount and position of the sail's draft. Many trimmers also put a black stripe along each side of the top leech batten to help them see the critical angle of that batten when the sail is trimmed. Another aid is a "trim line" that sailmakers draw on the clew of some jibs. Position the jib lead so this trim line is a straight extension of the jib sheet when the sail is trimmed upwind.

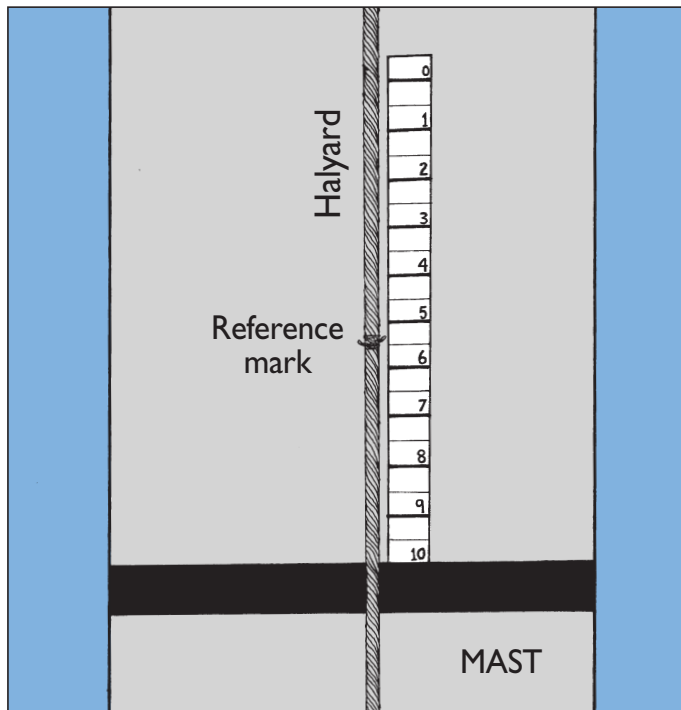


▲ **Jib sheet marks** – With your jib at its normal upwind trim, put a piece of tape or a magic marker mark on each sheet just forward of the turning block where it's easy to see. This gives the jib trimmer a quick and easy reference during the race (without even looking at the sail). Of course, you won't always trim to this mark because conditions change, but it's a helpful guide. Note the black 'trim line' on this clew that provides a rough guide for the ideal trim angle of the sheet.

▼ **Leech position** – If your jib trims in front of the shrouds, wrap contrasting tape around each spreader at regular intervals from its outboard end, and watch to see where the jib leech lines up. These marks give the trimmer a great reference point for jib sheet tension and lead position on each tack. If your genoa trims aft of the shrouds, use the distance between the end of the spreader and the sail as your reference.



◀ **Backstay tension** – The backstay is a critical sailshape tool, so you must have some way to measure how much tension is applied. This is easy on big boats with hydraulic pressure gauges, but difficult on most other boats because the backstay control line is usually double-ended, and it's not easy to calibrate the backstay itself. One solution is to fasten a measuring stick (this could be a simple ruler) alongside a reference mark (e.g. a piece of tape, seizing wire or hardware connector) on the lower backstay.



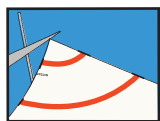
▲ **Jib luff tension** – If you use the jib halyard to adjust the luff tension of your sail, place a number scale on the mast alongside the loaded halyard where it is easy to see. For wire halyards, use a piece of seizing wire as your reference mark; for rope halyards, use a magic marker mark. This will give you an accurate idea of the relative luff tension in your sail.



▲ **Jib lead position** – The fore-and-aft position of your jib lead car is critical for sail shape, so you must know exactly where the lead is from race to race. If your track has holes for the car, number each hole (with higher numbers aft so they correspond to higher wind velocity). For tracks without holes, put a number scale (like the one for halyard tension above) alongside the track, and pull the car to the desired setting. Make sure numbers on each side of the boat match exactly.

If you sail a one-design, you may also want to calibrate your jib lead position (and other sail controls) in an absolute sense so you can compare your set-up to other boats. The jib lead location is a function of two measurements: 1) distance outboard from the boat's centerline; and 2) distance aft of a known fixed point such as the headstay. Find the fast numbers for your class and then mark these on your jib tracks.





# The most critical headsail control

The jib sheet is very important because it has a huge effect on the boat's overall speed and pointing ability. Just an inch or two of sheet trim makes a big difference in the shape of the sail. Here are some considerations:

**Use trimming marks.** As we discussed on the previous pages, the job of trimming the sheet can be a lot easier if you put certain marks on your sail and its control lines. These include draft stripes, a black line on the top batten and clew, and marks on the sheets and spreader tips. The trimmer must always be able to duplicate fast sheet settings.

### Three guides for trimming the sheet

Here are several different ways to judge proper jib sheet trim:

**1.** Trim the jib sheet until the upper leech batten (or, if you don't have battens, the upper part of the sail's leech area) is roughly parallel to the boat's centerline. (This is very similar to trimming the mainsheet so the mainsail's top batten is parallel to the boat's centerline).

If you are sailing in light air or chop, or if the jib is eased for acceleration, the top batten should angle outboard 5° to 10°. In optimum pointing conditions (moderate air and flat water), the batten will angle inboard about that much.

**2.** Trim the jib sheet in until the curve (i.e. the twist) in the jib leech matches the shape of the nearby section part of the main. The goal is to have a nice even slot between the two sails (looking from behind).

**3.** Trim the sheet to the point where it gives you the best performance relative to other boats. When the boat feels good and you are fast relative to the competition, try trimming a little harder. If you're slower than other boats, ease the sheet a little bit. This is a constant loop that requires a good feel for the boat and your relative speed and height.

**Help steer the boat.** The jib trimmer should play the sheet to help the helmsperson steer the boat using as little rudder as possible. If the boat needs to turn toward the wind, ease the jib sheet to reduce wind pressure on the jib and allow the bow of the boat to head up more easily. Conversely, trim the jib sheet to help push the bow away from the wind when you want to bear off.

A good example of steering with the jib occurs while sailing a shifty beat. When the boat gets a lift, the leeward telltales stall. It often takes the helmsperson a long time to turn the boat to windward and reattach flow, especially on heavier boats.

The jib trimmer can react to this lift much more quickly by easing the sheet until the telltales stream. This reattaches flow on the back of

the sail and makes it easier for the helmsperson to head up.

### A myth about pointing.

There is some logic to the belief that sheeting your jib tighter will allow you to point higher, and sometimes it does. But this is not automatic.

There are two reasons why tighter trim actually hurts pointing: First, when you sheet harder, the boat slows down because the sail's driving force shifts a little more to the side (to leeward) and less forward. That is OK if you gain pointing ability. But the problem is that in order to point higher you need to be going fast in the first place.

Second, trimming the jib harder makes the sail more square to the wind, which means there will be more force pushing the sail (and the bow of the boat) to leeward. That is



In windy conditions the jib trimmer should always sit on the windward side of the boat, except for brief moments to trim the jib after a tack (above) or when conditions change. Being on the high side is critical for speed and for the trimmer to see waves, puffs, lulls and boats that may affect jib trim. On some boats it's possible to 'cross-sheet' the sail to a winch on the windward side – this is good because it allows the trimmer to play the sheet without going to leeward. Note that this boat uses a jibsheet "in-hauler" (between the mast and the jib lead turning block) to move the jib lead angle inboard.

not what you want when you are trying to point higher.

Therefore, before you trim the jib tighter with the goal of improving pointing, make sure the boat is going fast. If you're not, easing the jib is the best way to point higher in the short term because it improves speed and frees the bow.

#### **Play the sheet constantly.**

Since the wind and waves are constantly changing, jib trim needs to be adjusted continuously. When the boat feels good (i.e. fast), try trimming the sheet in another inch. If you're slow or in doubt, let it out. Trimming tighter may be good for pointing, but it makes the boat more critical, while an eased sheet gives the boat a wider groove.

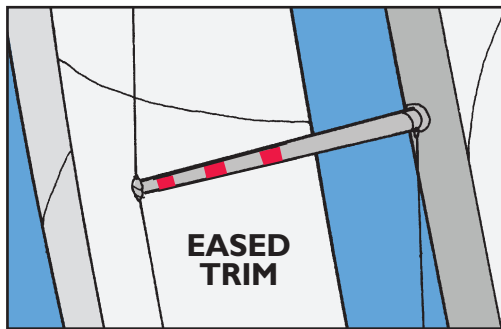
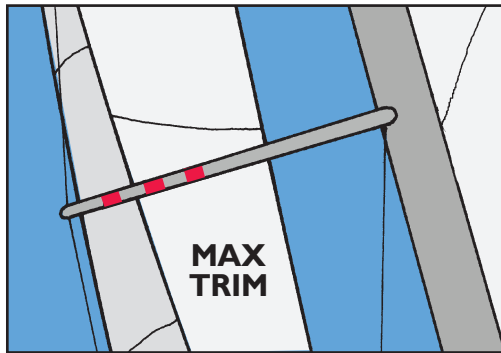
You don't have to adjust the sheet very far. On a J/24, for example, the full range from maximum trim to maximum ease is usually only between one and two inches. One thing that will make this range wider is big waves.

It's relatively easy to trim the jib sheet when nothing changes, but the real key is figuring out how to anticipate and make smooth transitions from flat spots to waves, from puffs to lulls, and vice versa.

**Communicate.** The jib is just one piece of what makes a boat go fast, so the trimmer needs to provide info about the jib to the rest of the crew. At the same time he or she needs to get info about what the mainsail trimmer is doing with the main, and what the skipper is doing and feeling with the boat.

If the trimmer eases the sheet slightly to power up, for example, he should tell the helm something like, "I can trim two more inches." Or if the trimmer has trimmed the sheet as tightly as possible for the conditions, she might say, "The jib is at maximum trim."

Conversely, the jib trimmer needs to hear about what is happening with the main and the boat's course. For example, he would be very interested if the main trimmer says, "I am dropping the traveler two inches to leeward," or if the helmsperson says, "I'm putting the bow down a little to build speed." •



#### **Use your spreaders**

When you are trimming the jib sheet, one of the best guides is the relative position of the jib leech. The spreaders provide an excellent visual reference for how much twist there is in the sail (i.e. how close the leech is being trimmed to the centerline of the boat).

In general, you want to trim the leech tighter without much twist in flat water and moderate wind. You need more twist in light or heavy air, in choppy conditions or when you are trying to accelerate.

In any wind and wave condition, the trimmer will play the jib sheet through a range of trim positions. For example, the maximum trim on that day may be at the middle spreader mark (left, top), while the maximum eased position might be two inches outside the spreader tip (left, bottom).

### **Hold the sheet . . . or cleat it?**

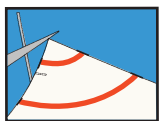
It has been debated for a long time on all types of boats: Should the jib trimmer hold the sheet in his or her hands, or put it in the cleat? The answer depends on a number of factors such as boat layout, the trimmer's strength and the wind and wave conditions. Here are some thoughts about the advantages and disadvantages of each method.

**CLEAT IT!** Many jib trimmers use a cleat most of the time while they are sailing upwind. The usual reason is that this is much easier than holding the sheet for an entire upwind leg, especially if there is a lot of pull from the sail. A cleat also has the advantage of providing a steady, solid jib trim setting – when the sheet is cleated it won't creep out when the trimmer gets tired or inattentive. However, the main disadvantage of cleating the sheet is that this makes the trimmer less likely to adjust trim (i.e. shift gears) when conditions change. Many trimmers default to leaving the sheet cleated unless there is a major change in the wind or waves, and that is not fast.

**HOLD IT!** The biggest advantage of having a trimmer hold the sheet in his or her hands is the ability to shift gears quickly. When the sheet is uncleated, it's easy to make adjustments for even the smallest changes in the wind, waves or the boat's sailing angle. Another small advantage is that the trimmer is always ready for an unexpected maneuver like a tack (think of those bad tacks when the sheet gets stuck in the old cleat!). However, sometimes the trimmer is not strong enough to hold the jib sheet very long upwind and other times the sheet is eased unknowingly; so the result of holding the sheet is often erratic trim and a tired crewmember.

**DO BOTH!** Often the best trimming technique is a hybrid of these two methods. If you can cleat the sheet but still have the ability to make quick trim adjustments, then you will have the best of both worlds. This requires keeping the sheet in your hand at all times (whether it is cleated or not), rigging your boat so it's very easy to get the sheet out of its cleat from your position on the windward rail and reducing the pull on the jib sheet in windy conditions (e.g. by using two-to-one sheets, ratchet blocks or a winch). By being smart, the trimmer can get the consistency and ease of trimming that comes from using a cleat, while maintaining the critical ability to change gears often.





## Searching for the best lead position

The fore-and-aft position of your jib car is critical for getting the right headsail shape. Moving the lead aft makes your headsail flatter and more twisted, which is good when you have a lot of wind.

Moving the lead forward gives you a tighter leech and a deeper sail. This is generally good in lighter air when you need a lot of power. However, you have to be careful about getting the leech too tight in light air, especially if there are any

### Two ways to set fore-and-aft lead position

Finding the right hole or position for your jib lead can be tricky because it is a function of the particular jib you are using and, of course, the specific wind and wave conditions in which you are racing. Here are two ways you can approach this:

1. Set the jib lead position so the telltales along the luff break evenly from top to bottom. In other words, as the boat heads up into the wind, the telltales on the windward side should all start lifting up at the same time. If the top telltale breaks first, move the lead forward; if the bottom one breaks first, move the lead aft.

This idea is great in theory, but in practice the top telltale usually breaks first. If you move the lead far enough forward so all the telltales break evenly, it may limit your ability to sheet the sail and cause too much backwind in the main. In conditions where you need a good bit of twist in the sail, such as in light or heavy wind or waves, it's OK to let the top telltale break a little early.

2. Set the jib lead position so that when you pull in the sheet the foot and leech of the sail trim in concert and reach their perfect trim at the same time. If the foot gets too tight before the leech is tight enough, move the lead forward. If the leech gets tight and there is still too much curvature in the foot, move the lead aft. This is my preferred method.

waves. In those conditions, the trimmer typically eases the sheet quite a bit – that's why he or she also has to move the lead forward, or the sail will twist too much.

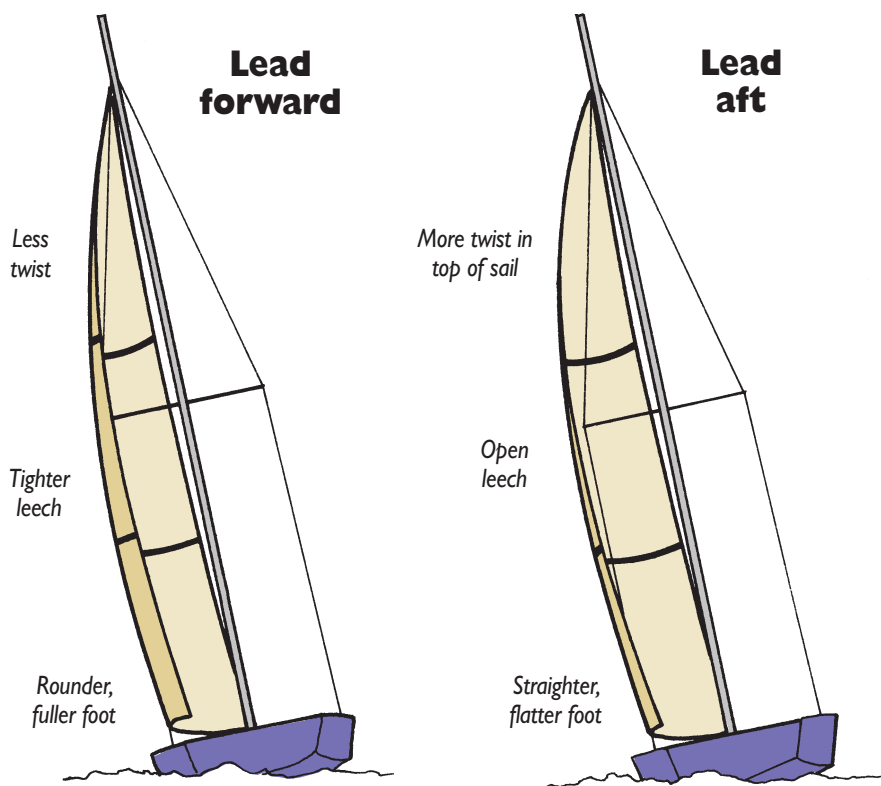
On some boats the trimmer is also able to change the lateral position of the jib lead. Many Stars, for example, have a two-dimensional jib track system (see photo) that allows the trimmer to put the lead almost anywhere he wants. On this page and the next are a bunch of ideas about how to properly set the position of your jib leads.

**Symmetric jib leads?** The jib lead should normally be positioned

in the same place on each tack, but watch out for asymmetries in the wind or water. It's not uncommon to have a condition where the jib lead needs to go farther forward on one side. Here are two situations when you should go with uneven leads.

- **The waves aren't lined up with the wind.** This might happen when you have a wind shift and the waves are still coming from the old wind direction. In that case, you want the lead farther forward on the bumpier tack (i.e. the tack that goes more directly into the waves).

- **There is wind sheer aloft.** Sometimes the wind up high comes



### Jib lead position works like the main outhaul

Moving the jib/genoa lead fore and aft affects foot depth, much like the outhaul controls foot depth on a mainsail. To add depth, move the lead forward (left). This shortens the distance between the clew and tack, which moves the foot of the sail farther away from its chordline. It also reduces twist and makes the leech tighter. This adds power to the sail, but too round a shape down low will give the sail a tight, hooked leech which can narrow the slot, stall wind flow and create backwind.

If you move the jib/genoa lead aft (right), this reduces depth in the foot. It makes the bottom half of the sail flatter and opens up the leech, creating more twist in the sail. This depowers the sail, but allows you to sheet the sail harder (because you can do this without making the leech too tight).





Some boats, like this Star, are rigged so their jib leads can be moved inboard and outboard as well as fore and aft. This gives the trimmer the ultimate flexibility about where to position the jib lead car. Note two things: 1) This boat has marks on its deck as a baseline setting for where the lead should go laterally. It would also be helpful to number the holes in the fore-and-aft tracks; and 2) The raised track is curved so the sheet tension will stay steady as the lead moves in and out.

from a slightly different direction than the wind at water level. If the top of your jib is seeing a shift to the left, for example, the lead on the port side should be farther forward so you have less twist in the top of the jib on starboard tack.

**Barberhauling.** On some boats, the existing (or class legal) jib lead tracks are too far outboard, so you need to change the lead angle by pulling the sheet or clew inboard. Smaller boats such as Flying Scots and 420s, for example, can do this by tensioning the windward jib sheet. Some bigger boats have a specially rigged jib in-hauler to do the same thing (see photo page 6).

In other situations you need to 'barberhaul' the jib sheet outboard. If you are sailing on a close reach, for example, the upwind lead position will be too far inboard. If there is a lot of backwind in the mainsail (such as when it's windy and you're overpowered), first try moving the jib lead aft; then, if necessary, move the lead outboard (see box at right for more on moving leads laterally).

**Changing gears.** On smaller boats, the jib trimmer normally changes gears primarily by easing and trimming the sheet (and by calling for changes in headstay sag). On bigger boats, however, he or she can also move the lead position (assuming it's easy to slide the jib car fore and aft). For example, when you ease the sheet for acceleration and power, pull the lead forward slightly at the same time. Then, as the boat gets going and you trim the sail in again, ease the lead aft. •

## Sheet inboard or outboard?

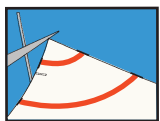
*Some boats have the ability to move their jib leads in and out (laterally) as well as fore and aft, which gives the trimmer more control over sheeting angle. A rule of thumb is to move the lead as far inboard as possible without hurting the mainsail or slowing the boat too much. A narrow angle reduces the sail's driving force but usually lets you point higher. This works best for high-efficiency conditions when the hull is easily driven. However, an inboard lead makes the sail more critical (i.e. more prone to stalling), so sheet inboard in ideal conditions but sheet outboard to play it safe whenever you are in doubt. Here are some specific situations when you might move the lead in or out.*

### Move the lead inboard when

- **Moderate wind** – Medium breeze is ideal for pointing, so take advantage of this with a narrower sheeting angle.
- **Flat water** – Smooth water is also great for pointing, especially when you have less waves than wind, such as a building breeze or an offshore breeze.
- **Pointing is your goal** – Moving the lead inboard usually helps you point higher, but not in less-than-ideal conditions or if you are going too slowly.
- **No backwind in the mainsail** – Try narrowing the slot until you just start to see backwind in the main; this will maximize power and pointing.
- **Efficient hull and foils** – When the boat is easily driven, it can point higher because it doesn't need as much driving force.

### Move the lead outboard when

- **Strong breeze** – An outboard lead depowers the sail, which is important when you start dropping the mainsail boom off centerline.
- **Bumpy water** – When sailing in waves you need sail shapes that have a wide groove and are forgiving; an outboard lead is safer than inboard.
- **Light wind** – Be careful of closing the slot too much in light air, especially when you have chop, shifty wind or bad air.
- **Footing is your goal** – One big reason to move the lead inboard is to point higher, so if that is not your goal move the lead outboard.
- **Backwind in the mainsail** – This is a sign that the slot may be too narrow; try fixing this by moving the lead a bit farther outboard.
- **Hard to find the 'groove'** – Trimming the jib to an inboard lead makes the sail more critical and easier to stall. If in doubt, move the lead out and help your helmsperson stay in the groove for a larger percentage of the time.



## HEADSTAY SAG

# Control power with luff sag

One of the most critical factors for any jib or genoa trimmer is the amount of sag in the headstay. Your forestay almost never forms a straight line between the bow and the mast – due to wind pressure it always sags aft and to leeward at least a little bit.

When the headstay sags it adds fullness to the jib. Think of laying your jib out flat on the floor; then push the middle of the luff toward the leech. The wrinkle that forms in the sail is the extra fullness created by headstay sag.

Conversely, when you reduce headstay sag (by straightening the headstay), you remove fullness from the middle of the sail. This is a lot like bending the mast more to make your mainsail flatter.

The primary way to fine-tune the amount of power in your head-

sail is by adjusting headstay sag. In light air and waves, add luff sag to make the sail more powerful and deeper. In heavy air and flat water, remove luff sag to improve pointing and avoid being overpowered.

Unfortunately, the jib trimmer doesn't usually have control over two things that have the greatest effect on headstay sag – backstay and mainsheet. So it's important to communicate and work with your helmsperson and mainsail trimmer.

Of course, the backstay affects the shape of the mainsail as much as the jib. However, the mainsail is attached to two rigid spars, so the main trimmer has many other ways to control its shape (e.g. tension on the lowers, position of the mast at the butt and partners). Therefore, jib shape should get priority when adjusting the backstay.

Fortunately, most adjustments made to the mainsail are good for the jib, too. When the boat gets a puff, for example, the skipper trims the mainsheet. This adds bend to the mast, which flattens the main, and also straightens the headstay, which flattens the jib.

Changing the amount of headstay sag has a huge effect on the overall fullness and power in the sail, and that's why it should be one of the jib trimmer's top priorities for shifting gears. However, luff sag also has a big impact on the location of maximum draft in the sail. More sag moves the draft forward in the sail, while less sag moves the draft aft. Therefore, whenever you change the amount of sag, vary luff tension to fine-tune the position of maximum draft (see pages 12-13).

## Four things that affect headstay sag

There are several ways in which a trimmer can reduce or increase the amount of headstay (luff) sag:

**1. Backstay** – The backstay pulls aft on the top of the mast and has a significant effect on how much the headstay sags. If your boat has running backstays, these affect jib shape even more because they attach to the mast right at the hounds where the headstay also attaches.

**2. Mainsheet** – The sheet pulls directly on the top of the mast (via the leech of the sail) and therefore has a large impact on luff sag, especially on boats without a backstay.

**3. Boom vang** – The vang pulls the mainsail leech tight and may have a large influence on sag, but only if it is anchored to the boat (if it attaches to the mast it won't have nearly as much effect on sag).

**4. Overall rig tension** – When the upper shrouds are based aft of the mast, tensioning them will pull the top of the rig aft and reduce luff sag. This is a key control on boats that don't have backstays.



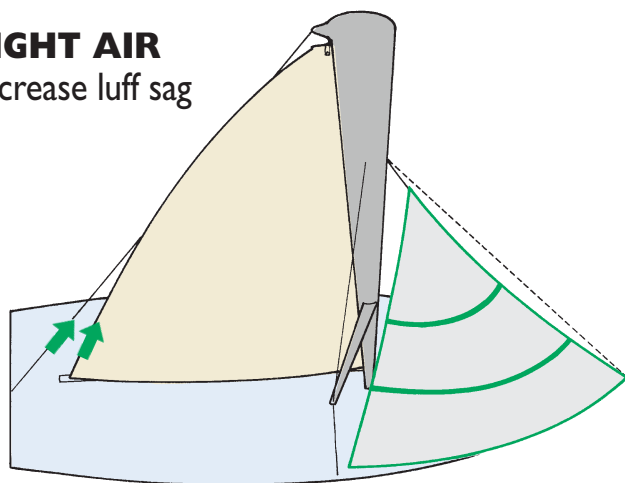
JH Peterson photo

On boats without backstays, like this Flying Scot, the amount of luff sag is a function of rig tension and mainsail leech tension. When boats don't have a backstay, their shrouds must be attached aft of the mast to keep the rig from going over the bow downwind. Because of this, the shrouds apply tension to the forestay. While the boat is sailing upwind, tension on the mainsheet and the vang transfers through the mainsail leech and pulls aft on the top of the mast. This makes the headstay tighter, reducing luff sag.



## LIGHT AIR

Increase luff sag



**Y**ou want a good bit of headstay sag when you are underpowered and whenever it's more important to foot than point. This is generally whenever the breeze is light, when you have more waves than wind, or when you need to accelerate. Sag moves the luff of the sail aft (closer to the leech), and thereby adds depth to the jib. This added depth will be most noticeable in the forward part of the sail and in the upper half where the sag is larger relative to the sail's chord length.

**How to increase sag:** There are several ways to do this: 1) Ease your mainsheet and/or vang; 2) Let off on the backstay or running backstay; or 3) Loosen your overall rig tension.

**What it does:** By increasing headstay sag, you add fullness to the jib or genoa, especially in the forward sections. This fuller shape gives you more power for acceleration and better speed in light air or waves, plus a more forgiving 'groove.'

**Trimming comments:** Loosening the headstay rounds up the front of the sail, so you should simultaneously ease the sail's luff tension or the draft will be too far forward.

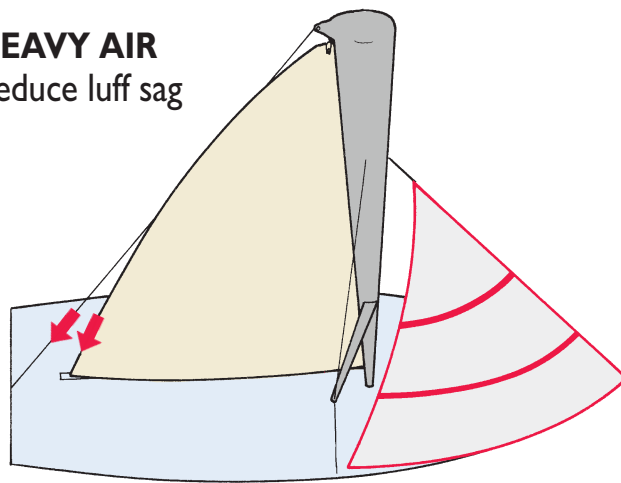


*In light air upwind, you need a powerful headsail with a full shape, especially when sailing in waves. Here the backstay is eased to allow the headstay to sag and push fullness into the sail. You can see that the sail is deep overall and the front section is quite round, which is good for power and acceleration.*

**Other notes:** The halyard is eased so the draft does not move too far forward when the headstay sags. The sheet is also eased enough so the leech is not too tight. The top batten falls off slightly to leeward and you can see by the position of the leech on the spreader that there is a good deal of twist.

## HEAVY AIR

Reduce luff sag



**M**inimize headstay sag whenever you are overpowered and whenever pointing is important. In general, this is when it's windy or when you have fewer waves than wind and at least a moderate breeze. But don't go overboard. If you have too little sag, the entry of the jib will be very fine and make steering difficult. The boat won't track, and the leeward tell-tales will stall easily. If this happens, add headstay sag.

**How to reduce sag:** There are several ways: 1) Pull harder on your mainsheet and/or vang; 2) Tighten the backstay or running backstay; and/or 3) Increase your overall rig tension.

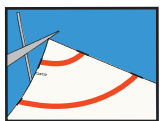
**What it does:** By straightening the headstay you pull fullness out of the middle of the jib or genoa. This flatter shape lets you point higher and is more efficient in a breeze. However, a flat entry makes steering more critical, and if you hit a lull or waves you may be hurting for power.

**Trimming comments:** Tightening the headstay moves the draft aft in the sail, so you will have to increase luff tension to keep the draft forward (at 40% - 45% aft of the luff).



*In heavy air, pull the backstay tighter to reduce headstay sag and flatten the sail overall. This depowers the sail and helps the boat point higher. This sail is not nearly as deep or draft-forward as the light-air shape on the left.*

**Other notes:** The halyard has been tensioned quite a bit to keep the draft forward. The sheet is trimmed hard so the top batten is parallel to the boat's centerline and the mid-leech trims close to the rig (see its position on the spreader). In addition, the lead is slightly farther aft so the sheet can be trimmed hard without making the leech too tight.



# Fine-tune draft position

In most conditions, the position of maximum depth in your jib or genoa should be between 40% and 45% aft of the luff. In other words, the deepest part of the sail should be a bit forward of the middle of the sail (and farther forward than the position of max draft in the main).

The jib trimmer has two basic ways to adjust the position of draft in the sail. The first is with headstay, or luff, sag. Increasing the amount of headstay sag (by easing the backstay or mainsheet) makes the genoa fuller and moves the draft forward. When the headstay is quite loose, it's common for the sail to be very round and deep in the front. If you pull the headstay very tight, the front of the sail becomes flat and the draft moves well aft.

The second way to adjust draft position in the sail is by changing the amount of tension in the fabric along the luff. You can do this with either the jib halyard or a jib-cloth downhaul (much like the mainsail cunningham) if your boat has one.

More tension on the luff moves the draft forward while less tension eases the draft aft. The softer a jib's fabric, the more its shape will be affected by luff tension. Sails made with stiffer materials such as Mylar

and Kevlar don't stretch a lot so changing the luff tension will not affect their shape very much.

For almost every sail, headstay sag has a bigger effect on draft position than luff tension. That's why the trimmer should first adjust luff sag to get the right amount of fullness in the sail. Then he or she can fine-tune the halyard or cloth downhaul to get the draft in the right place for the particular wind and wave conditions.

In light air, for example, the trimmer usually wants a lot of headstay sag for maximum fullness and power. But sagging the headstay often moves the draft too far forward in the sail, so he or she needs to ease the halyard to let the draft move aft.

In heavy air, the headstay needs to be very tight to depower the sail and allow the boat to point high. When you have very little luff sag, the draft often moves too far aft in the sail, so the trimmer needs to tension the halyard to pull the draft forward to its normal position.

In most cases, the goal is to get the draft in the 40% to 45% range. Aim for the lower part of this range (i.e. move the draft forward) to make the sail more forgiving and give the

boat a wider groove in light air, chop or shifty wind. Aim for the top of that range (i.e. move the draft aft a bit) when conditions are steadier (i.e. when you don't need such a wide groove) and you can go for maximum pointing in smooth water and moderate air. Remember that increasing luff tension also makes the sail flatter, so be careful not to pull too hard on the halyard when looking for power.

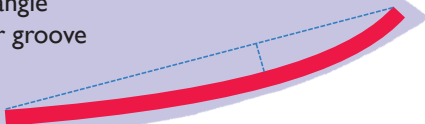
The jib halyard (like the mainsail cunningham) is not intended primarily for removing wrinkles to make the sail look better. It's main purpose is to adjust luff tension and thereby control the position of draft in the sail.

A good guide for proper luff tension are the wrinkles along the luff of your jib. In light wind you usually want some obvious 'crow's feet' at each snap or Velcro tab.

In heavy air, you typically want to see just a hint of wrinkles, or no wrinkles at all if you are trying to depower the sail. You might also tension the halyard enough to remove all wrinkles for a sail made of stiff fabric, or for a softer sail that is older (and needs extra luff tension to move the draft that has blown too far aft in the sail over time). •

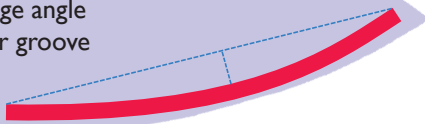
### More luff tension

Fuller, rounder entry  
Wider leading edge angle  
More forgiving, wider groove  
Flatter sail overall



### Less luff tension

Finer, straighter entry  
Narrower leading edge angle  
Less forgiving, smaller groove  
Fuller sail overall



### What luff tension does

The jib halyard and/or jib cunningham control the tension on the fabric along the luff of your jib or genoa. By adjusting these, you have a certain degree of control over the sail's shape (i.e. its depth, draft distribution and leading edge angle).

If you pull harder on the halyard, for example, it moves the head of the sail farther away from the tack, increasing tension on the sail fabric between these two points. This does two things. First, it pulls more cloth toward the luff of the sail, which moves the point of maximum depth in the sail farther forward and makes the front of the sail rounder.

Second, when you pull the corners of the sail farther apart you make that sail flatter. So pulling on the halyard (or cunningham) also removes depth from the sail. Conversely, if you ease the halyard or jib cunningham this moves the head closer to the tack, which makes the sail fuller and allows the position of max draft to move aft.





Sometimes the presence (or absence) of wrinkles along the luff of your sail is a helpful guide for getting the right luff tension. In light air (*above*), it's usually good to see some obvious 'speed wrinkles' in your jib. This lets you know that the halyard is eased and the sail is as full and powerful as it can be. One exception is laminated sails where you typically see only a hint of wrinkles along the luff in light air. In heavy air, most sails are fastest with enough luff tension to remove all the wrinkles.

### Two ways to adjust luff tension

To change the tension along the luff of a jib or genoa you can either pull down on the tack of the sail or pull up on its head. Some boats have a jib cloth control that is attached to the sail at its tack. This works a lot like the main cunningham; pull it harder to get more luff tension, fewer wrinkles and a flatter sail with its draft farther forward. Ease the jib cloth to get less luff tension, more 'speed wrinkles' and a fuller sail with its draft farther aft. When you pull on the tack of the sail, you affect the shape mostly in the lower half of the sail.

On other boats, you adjust luff tension by pulling up on the head of the sail. This can be done easily on most headsails by pulling harder on or easing the jib/genoa halyard. It's similar to using the main halyard to control the luff tension, and therefore the shape, of the mainsail. When you pull on the head of the sail, you will have the biggest impact on shape in the upper half of the sail.

## Create a wider 'groove'

If your helmsperson is having a hard time finding or staying in the 'groove' upwind (which is common in shifty winds, bumpy seas, light air), make the steering groove wider with a fuller, more draft-forward headsail. Even though this will sacrifice some of your ability to point high, it should improve overall performance by increasing the percentage of time that you are able to sail fast in the groove.

The groove is that optimum combination of sail trim, boatspeed and pointing ability where your boat comes alive and achieves near-optimal upwind performance. We are always searching for the groove when we sail upwind. When you have a hard time finding it, there could be several explanations. You may have an inexperienced helmsperson, a breeze that is light or shifty, tricky waves, sails that are not trimmed optimally, or some combination of the above.

No matter what the reason, a good solution is to set up your sails so the helmsperson has a wider groove. You can do this by easing the sheet a little and by making the front of your jib or genoa rounder (usually by increasing headstay sag and making sure the luff tension is not too loose). With more curvature in the front of your jib you'll have a wider leading edge angle and it will be easier for the wind to stay attached to the sail.

A draft-forward shape is more forgiving because it is harder to stall. In other words, the skipper can make wider course changes (up and down waves, through lifts, headers, puffs and lulls) while still keeping flow attached to the sail most of the time. There will be fewer times when you stall out and go slowly. With a forgiving jib shape, you'll be fast more of the time and improve your overall average speed (especially when conditions make it hard to stay in the groove).

The disadvantage of widening the groove is that it harms your pointing ability. But it's usually better to point a little lower with good speed than to have a jib that points high but is 'in the groove' only a small percentage of the time. •

## Make your jib more forgiving

*There are several things a trimmer can do to make the jib or genoa more forgiving and get a wider groove.*

**1. Ease the sheet** – This is the top priority because it's easy to do and has a huge effect. A tightly trimmed headsail has a very narrow range where it's fast – it will easily stall and go slow, especially in light air or waves. Avoid this by easing the sheet to add twist, let the sail breathe and encourage the helm to sail lower and faster.

**2. Make the sail fuller** – A deeper sail is more powerful, which makes it easier for the helmsperson to maintain speed. This hurts pointing, but in marginal conditions you should set up the jib so the helmsperson is not tempted to point very high.

**3. Move draft forward** – Make the front of the jib rounder (by increasing headstay sag and luff tension) to make it easier for the wind to stay attached to the sail.



# Tips for jib and genoa telltales

One of the best sailshape tools for a jib trimmer are telltales placed on each side of the sail along the luff. The position of these telltales varies slightly from boat to boat, but usually they are located about 8 to 12 inches aft of the luff of the sail. Three sets of telltales are the norm, evenly spaced up the luff.

When sailing upwind (or at any other angle of sail), the leeward telltales should never droop. If they hang limp, the sail is stalled – either the skipper is not heading high enough or the sail is overtrimmed. When this happens the trimmer should ease the sheet to reattach flow. If the leeward telltales are stalling too easily or frequently, the sail's leading edge angle may be too narrow (i.e. the luff of the may be too fine or flat). Fix this by letting the headstay sag more and getting a little more luff tension to round up the front of the sail.

Telltales along the jib luff are good indicators of the upwind “groove.” You should usually sail to windward with the weather telltales just lifting above a horizontal

position. In flat water and medium to heavy air, you can sail in “feathering” mode with the windward telltales lifting vertically. When you are starved for power (e.g. in light air, waves), put the bow down a little so you sail with both telltales streaming straight aft.

- **Steer by the middle telltales** – If you watch the jib luff telltales to help with steering the boat upwind (and I think almost everyone does), be sure to use the telltales that are half way up the sail. These are harder to see than the lower telltales, so you may have to sit farther forward or to windward to see them. This will be worth it, however, because the middle telltales give you the best average reading for the entire sail.

- **Use a leech telltale** – Try looking occasionally at the telltale on the leech of your jib near the top batten. When your sail is fully trimmed upwind, is this telltale stalled all the time, half the time, none of the time or something else? Look for patterns that will help you find the fastest trim across the range of conditions.

## Case study of a well-rigged boat

There is a lot we can learn about telltales (and other stuff) from this simple photo of a handicap boat racing upwind.

- **Telltale series** Most sails have pairs of telltales at several points along the luff, but this jib has a row of three pairs at each location. This set-up gives the helmsperson and trimmer more accurate readings and more warning about changes to come. It helps them see the size of the steering groove (e.g. if all three windward telltales flutter at the same time, the sail has a flat entry and a narrow groove), and it avoids a common problem where telltales don't work effectively because they are too close to or too far from the luff.

- **Telltales near stripes** All the telltales are located near draft stripes. This makes it easy to see the action of the telltales and the corresponding shape of the sail simultaneously. If the draft stripe shows a fine entry (narrow leading edge angle), for example, you'd expect to see all three telltales acting similarly. But if the draft stripe shows a round entry, the telltales should behave more independently.

- **Color coordination** The telltales on the port side of the sail are all red. It is likely that the telltales on the starboard side are all green (and slightly offset from the red ones) so it's easier for the helmsperson to distinguish between the windward and leeward telltales. The draft stripes don't have to be different colors on each side because they are positioned back-to-back and, unlike the telltales, show exactly the same shape on each side of the sail.

- **Night window** There is a clear window near the middle of the luff with a pair of telltales. This is for night racing when it's difficult to see the leeward telltales through the sail fabric.

- **Draft stripes** These sails have simple, clear draft stripes that make it easy to visualize their shape. One refinement is the addition of a small mark at the middle of each stripe (half way between luff and leech). This is a helpful reference for judging the position of maximum draft. You can see, for example, that the deepest part of the jib is quite a bit forward of the mid-mark. This is consistent with the target draft position of around 40% aft for most headsails. The deepest part of the main is just slightly in front of the mid-mark. This is close to the typical mainsail draft position of 45% to 50% aft.



JH Peterson photo



## Focus on shifting gears

A lot of jib trimmers simply trim in the headsail, cleat it and then basically forget it. They don't understand how critical it is to keep adjusting the trim while conditions change. Your headsail may not be as much of an engine as the main, but it does produce a good bit of the boat's driving force, and it definitely helps the main work better. So you want the jib working near 100% all the way around the course.

Sailing conditions are always changing, and this means you must continually adjust the shape of your headsail if you want to keep going fast. There's almost nothing slower than leaving your sheet (and any other control) cleated when you get a change in wind or waves.

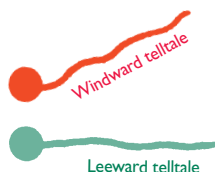
The deep, powerful jib shape that works well in six knots of wind and chop is not what you want when you get a 12-knot puff. When you see the puff getting close, pull the backstay to reduce headstay sag, and trim the sheet harder. It would also be good to move the jib lead aft slightly and get more luff tension, but those changes are harder to make on most boats, so worry about them only if it looks like the extra wind velocity will be sustained for a while.

Start making changes before the new wind gets to you. As Buddy Melges says, you must 'present your boat for Mother Nature.' Be proactive so the sail's shape is optimized as the new wind hits it. Don't just react to what you feel because that will put you behind.

The ability to change gears effectively requires a number of skills from the jib trimmer:

- **Anticipation** – If you want to present your boat for the wind and waves that are coming, you have to know what's coming. This means sitting on the windward side of the boat whenever possible and keeping a good lookout. Will you be getting a puff, lull, big wave? When will it hit you, and how much of a change is it from your current conditions?

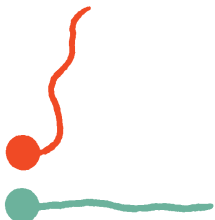
- **Communication** – Listen to the rest of your teammates about



**Normal mode** Windward telltales lift slightly most of the time. Trim in this mode when you are looking for an optimal combination of speed and pointing to maximize VMG upwind.



**Speed mode** Both windward and leeward telltales stream straight aft. Put your bow down into this 'footing' mode when you: 1) are racing in light air, especially with waves; 2) need to accelerate; or 3) need to go fast for tactical or strategic reasons. To shift into speed mode, ease the jib sheet slightly and increase luff sag to power up your headsail.



**Point mode** The windward telltales fly nearly straight up most of the time, and the front of the jib often luffs. This mode is good when: 1) you are trying to maximize pointing in moderate wind and smooth water; or 2) you need to 'feather' or 'pinch' to depower when it's windy. Shift into 'point mode' by trimming the sheet a little harder and reducing luff sag so the sail is flatter with a fine entry (i.e. a smaller leading edge angle).



**Slow mode!** You never want to sail with the leeward telltales stalled. Ease your jib sheet or get the helmsperson to head up closer to the wind (or do a combination of the two) until the leeward telltales flow straight aft.

what they are seeing and expecting. In which mode does the helmsperson want to be driving (see above)? Tell the helmsperson and mainsail trimmer what you are doing with jib shape. Since you rely on other crewmembers to play certain jib shape controls (e.g. the backstay), you must have a clear system about how to ask for help with adjustments.

- **Preparation** – The job of trimming the jib requires hard work and focus. You need a mental picture of target sail shapes, and you must understand how your controls work to achieve those shapes. Make sure to mark and calibrate all the sail controls so you can re-create fast sail shapes.

It's relatively easy to set the jib up in steady conditions, but the real key is figuring out how to make smooth transitions from flat spots to waves, from puffs to lulls and vice versa. •

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## GOOD ADVICE

### Trim guide for headsail controls

Jib Controls	Light Air (< 8 knots)	Medium Air (8-15 knots)	Heavy Air (> 15 knots)
<b>Jib sheet</b>	Not too tight. If in doubt, let it out – especially in waves. Top (leech) batten slightly 'open'; twisted to leeward as much as 10°. More waves = more twist. Leech 2" outside spreader tip.	Maximum trim in middle and upper end of wind range (and in lower end with flat water). Top (leech) batten angled slightly to windward (of boat's centerline) in ideal pointing conditions. Leech 3" inside spreader tip.	Slightly eased as you get overpowered or if waves are bigger than wind. Top (leech) batten slightly open. More twist if mainsheet or traveler eased to depower. Leech between 1" outside and 1" inside spreader tip.
<b>Jib lead position</b>	Slightly forward, so you won't have too much twist when you ease the sheet for speed.  Moderate lead angle, wider in waves.	Position lead so luff telltales break evenly from top to bottom – or so the foot and leech reach maximum trim at the same time.  Narrowest lead angle to optimize pointing.	Slightly aft to add twist and reduce backwinding, especially if main is eased to depower.  Wider lead angle to depower and reduce backwind, especially in waves or if main is eased to depower.
<b>Headstay sag</b>	Maximum sag, especially in chop, to keep sail powered up. Backstay just tight enough to remove slack and steady rig.  Relatively full sail with curved, powerful leech.	Moderate sag at low end of wind range; minimum sag at upper end, especially in flat water.  Fairly flat sail. Straighter leech exit, foot and leech trimmed quite tight.	Maximum backstay; as little sag as possible to depower and optimize pointing.  Very flat sailshape. No wrinkles, very straight leech exit.
<b>Luff tension</b>	Loose for fullness and to move draft aft. Obvious 'speed wrinkles' in Dacron sail. Hint of 'speed wrinkles' along luff in composite sail.	Tight enough to keep position of max draft about 40% of the way aft. Hint of wrinkles in Dacron sail, especially at lower end of wind range.	Quite tight to flatten and depower the sail, move draft forward and open the leech. No wrinkles.